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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No. 89190.115603

In Re Application Of: Kevin R. Keegan et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/801,740	March 16, 2004	I. Akram	23,469	1795	1846

Invention: **REFORMER START-UP STRATEGY FOR USE IN A SOLID OXIDE FUEL CELL CONTROL SYSTEM**

COMMISSIONER FOR PATENTS:

Transmitted herewith is the Appeal Brief in this application, with respect to the Notice of Appeal filed on:
May 23, 2008

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Signature

Dated: **July 23, 2008**

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Joyce Petruzzelli

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CERTIFICATE OF MAILING BY FIRST CLASS MAIL (37 CFR 1.8) Applicant(s): Kevin R. Keegan et al.			Docket No. 89190.115603/DP-310836	
Application No.	Filing Date	Examiner	Customer No.	Group Art Unit
10/801,740	March 16, 2004	I. Akram	23,469	1795

Invention: REFORMER START-UP STRATEGY FOR USE IN A SOLID OXIDE FUEL CELL CONTROL SYSTEM

I hereby certify that this **Appeal Brief Under 37 C.F.R. Subsection 41.37 (26 pages + 1 duplicate page)**
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IN THE UNITED STATES PATENT & TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant(s):	Kevin R. Keegan et al.	Examiner: I. Akram
Serial No.:	10/801,740	Art Unit: 1795
Filed:	March 16, 2004	
For:	REFORMER START-UP STRATEGY FOR USE IN A SOLID OXIDE FUEL CELL CONTROL SYSTEM	

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
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Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the final rejection of the Examiner mailed January 23, 2008 rejecting claims 1-19.

The Commissioner is hereby authorized to charge the fee of $510.00 required under 37 C.F.R. § 41.20(b)(2), and any other fee which may be due, or credit any overpayment, to Deposit Account No. 10-0223. Further, if necessary, please consider this submission as a petition for an extension of time and charge any necessary fees that may be due to the Deposit Account listed above.

07/25/2008 RMEBRAHT 00000109 100223 10801740
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TABLE OF AUTHORITIES

I. REAL PARTY IN INTEREST

The subject application is owned by Delphi Technologies, Inc. of P.O. Box 5052, Troy, Michigan 48007-5052.

II. RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences which would have any bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-19 have been rejected and are subject to this appeal.

IV. STATUS OF AMENDMENTS

In view of the Final Office Action mailed on January 23, 2008, Appellants submitted a Response to Final Office Action that was mailed on March 24, 2008. No amendments were made at that time.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present patent application includes pending independent claims 1, 6, 8, 10 and 15. Pursuant to 37 C.F.R. § 41.37(c)(1)(v), Appellants are required to provide a "concise explanation of the subject matter defined in each of the independent claims involved in the appeal, which shall refer to the specification by page and line number, and to the drawing, if any, by reference characters." Therefore, the concise explanation of the subject matter set forth below is

mapped to independent claims 1, 6, 8, 10 and 15. *See* 37 C.F.R. § 41.37(c)(1)(v); MPEP 1205.02.

As set forth in independent claim 1, the present invention is generally directed to a method for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature utilizing an electronic control module. *See Specification*, pg. 1, lines 8-11; pg. 3, lines 4-10, 23-27; pg. 4, line 27 through pg. 5, line 7. The method comprises the steps of: a) selecting a fuel type to be combusted; b) determining the latent heat of combustion of the selected fuel type; c) selecting a flow rate of the combustion fuel; d) determining the heat capacity of the catalyst to be heated in the catalytic reformer; e) determining a mass of the reformer to be heated; f) determining a starting temperature of the catalytic reformer; g) utilizing a software construct to produce the fuel combustion time interval, wherein the construct utilizes the latent heat of combustion, the selected combustion fuel flow rate, the heat capacity of the catalyst, the mass to be heated, and the starting temperature; and h) pre-heating the hydrocarbon catalytic reformer using a combustor for the fuel combustion time interval so that the hydrocarbon catalytic reformer reaches the minimum reforming temperature. *See id.* at pg. 4, lines 3-6; pg. 6, lines 3-16; pg. 12, lines 3-11.

As set forth in independent claim 6, the present invention is directed to a catalytic hydrocarbon reformer for making reformate comprising an electronic control module for controlling the flow of hydrocarbon fuel and air into the reformer. *See id.* at pg. 3, lines 23-27; FIG. 1. The electronic control module is

programmed with a software construct for determining a fuel combustion time interval for pre-heating said hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature. *See id.* at pg. 1, lines 8-11; pg. 3, lines 4-10; pg. 4, lines 3-6; pg. 6, lines 3-16.

As set forth in dependent claim 8, the present invention is directed to a catalytic hydrocarbon reformer in accordance with claim 6 wherein the software construct is an algorithm having the linear form y = mx + b, and wherein y is the minimum reforming temperature, b is the starting temperature, m is an integral of a product of the latent heat of combustion of the fuel times the selected flow rate of the fuel, divided by a product of the mass of the reformer to be heated times the heat capacity of the mass; and x is the fuel combustion time interval. *See id.* at pg. 6, lines 3-13.

As set forth in dependent claim 9, the present invention is directed to a catalytic hydrocarbon reformer in accordance with claim 6 wherein the fuel cell assembly includes a solid oxide fuel cell. *See id.* at pg. 1, lines 3-4, 15-16.

As set forth in independent claim 10, the present invention is directed to a computing system having a processor, a memory and an operating environment operable to execute a method for determining a fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature. *See id.* at pg. 1, lines 8-11; pg. 3, lines 4-10; pg. 4, lines 3-17; pg. 6, lines 3-16. The method comprises: a) selecting a fuel type to be combusted; b) determining the latent heat of combustion of the selected fuel type; c) selecting a flow rate of the combustion fuel; d) determining

the heat capacity of the catalyst to be heated in the catalytic reformer; e) determining a mass of the reformer to be heated; f) determining a starting temperature of the catalytic reformer; and g) utilizing a software construct to produce the fuel combustion time interval, wherein the construct utilizes the latent heat of combustion, the selected combustion fuel flow rate, the heat capacity of the catalyst, the mass to be heated, and the starting temperature. *See id.* at pg. 4, lines 3-6; pg. 6, lines 3-16; pg. 12, lines 3-11.

As set forth in independent claim 15, the present invention is directed to a computer readable medium having computer executable instructions of a wired media type for performing a method for determining a fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature. *See id.* at pg. 1, lines 8-11; pg. 3, lines 4-10; pg. 4, lines 3-26; pg. 6, lines 3-16. The computer executable instructions comprising the steps of: a) selecting a fuel type to be combusted; b) determining the latent heat of combustion of the selected fuel type; c) selecting a flow rate of the combustion fuel; d) determining the heat capacity of the catalyst to be heated in the catalytic reformer; e) determining a mass of said reformer to be heated; f) determining a starting temperature of the catalytic reformer; and g) utilizing a software construct to produce the fuel combustion time interval, wherein the construct utilizes the latent heat of combustion, the selected combustion fuel flow rate, the heat capacity of the catalyst, the mass to be heated, and the starting temperature. *See id.* at pg. 4, lines 3-6; pg. 6, lines 3-16; pg. 12, lines 3-11.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 6 and 7 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Publication No. 2002/0071974 to Yamaoka ("the Yamaoka reference").

Claims 1-5 and 10-19 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Publication No. 2003/0101713 to Dalla Betta ("the Dalla reference") in view of the Yamaoka reference.

Claim 8 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Yamaoka reference in view of the Dalla reference.

Claim 9 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Yamaoka reference in view of U.S. Patent Publication No. 2002/0150532 to Grieve ("the Grieve reference").

VII. ARGUMENT

Issue 1 – Whether claims 6 and 7 are anticipated under 35 U.S.C. § 102(b) based on the Yamaoka reference.

Independent claim 6 is directed to a catalytic hydrocarbon reformer for making reformate comprising an electronic control module for controlling the flow of hydrocarbon fuel and air into the reformer. The electronic control module is programmed with a software construct for determining a fuel combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature.

In order to establish a prima facie case of anticipation, the Yamaoka reference must disclose each and every element set forth in claim 6. *See W.L. Gore & Assoc. v. Garlock*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983). Therefore, if the Yamaoka reference fails to teach one of the limitations included in claim 6, then the rejection of claim 6 must be reversed.

Appellants submit that the Yamaoka reference does not teach or suggest a catalytic hydrocarbon reformer including an electronic control module that is programmed with a software construct for determining a fuel combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature as recited in claim 6. In the Final Office Action, the Examiner acknowledged that the Yamaoka reference does not explicitly disclose calculating a fuel combustion time interval, but instead relies on an implicit teaching therein. *See Final Office Action*, pg. 2, ¶ 3.

It is the Examiner's burden to "make it clear that the missing descriptive matter is necessarily present in the thing described in the prior art reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). "Inherency, however, may not be established by probabilities or possibilities." *Id.* at 1269, 20 USPQ2d at 1749 (quoting *In re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (C.C.P.A. 1981)). "The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* Thus, the Examiner is required to provide some specific evidence or scientific reasoning to establish the reasonableness of the Examiner's belief that a fuel

combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature is inherently disclosed in the Yamaoka reference. *See Ex parte Skinner*, 2 USPQ2d 1788, 1789 (B.P.A.I. 1986).

Initially, the Examiner pointed to the Abstract of the Yamaoka reference in order to teach a fuel combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature. *See Final Office Action*, pg. 3, ¶ 6. In the abstract, the Yamaoka reference states that a fuel reforming apparatus includes a heating device that heats raw fuel to a target temperature, wherein the target temperature is based upon the quantity of raw fuel being supplied to the heating device. *See Yamaoka*, Abstract, ¶ [0010]. However, based upon this section of the Yamaoka reference, there is nothing that discloses that a starting temperature of the reformer and a minimum reforming temperature for the reformer are used in a software construct to determine a fuel combustion time interval for the heating device. Moreover, a starting temperature of the reformer and a minimum reforming temperature of the reformer are not even mentioned in the Abstract of the Yamaoka reference.

The Examiner is also looking to the control device recited in the Abstract and the quantity of fuel flow as compared with time, as shown in FIG. 6 of the Yamaoka reference, to implicitly calculate a reforming time using flow rates. *See Final Office Action*, pg. 2, ¶ 3. First, it should be noted that the Examiner's implicit teaching of a reforming time does not even coincide with the language set

forth in claim 6. Claim 6 is specifically directed to a fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer, not a reforming time interval. In other words, claim 6 is directed to the amount of time that a reformer is pre-heated using fuel combustion, not the amount of time that reforming takes place.

Second, the two graphs shown in FIG. 6 of the Yamaoka reference do not explicitly or implicitly disclose any fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer. Instead, FIG. 6 merely discloses "a correction value of a quantity of fuel for burning at a transient time when a quantity of raw fuel changes as a step function." *Yamaoka*, pg. 2, ¶ [0023]. Appellants submit that it is unreasonable to conclude in view of what is shown in FIG. 6 that the Yamaoka reference necessarily utilizes a fuel combustion time interval for pre-heating the reformer (4) just because the fuel correction value is dependent upon time. Moreover, the fact that the Yamaoka reference could possibly use a fuel combustion time interval for pre-heating the reformer (4) is insufficient to establish a prima facie case of anticipation based on inherency. Again, "[i]nherency . . . may not be established by probabilities or possibilities." *Continental*, 948 F.2d at 1269, 20 USPQ2d at 1749. "The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.*

Another possible arrangement is for the Yamaoka reference to use a temperature probe that is located in a position that results in a time lag between the actual temperature of the catalytic elements within the reformer (4) and the temperature response of the temperature probe, thereby resulting in a fuel combustion time interval that is longer than required and a reforming catalyst that

is warmer than what is required to begin reforming. *See Specification*, pg. 5, line 25 through pg. 6, line 2. Since there is at least one other method in which the reformer (4) in the Yamaoka reference could be preheated, assuming that any preheating exists at all in the Yamaoka reference, Appellants submit that there has been insufficient evidence presented to establish that <u>a fuel combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature</u> is necessarily disclosed in the Yamaoka reference.

For at least the reasons set forth above, Appellants submit that a prima facie case of anticipation has not been established based on the Yamaoka reference. Appellants request that the rejection of claim 6 be reversed. As claim 7 depends from claim 6, it is requested that the rejection of claim 7 be reversed as well.

Issue 2 – Whether claims 1-5 and 10-19 are unpatentable under 35 U.S.C. § 103(a) based on the Dalla reference in view of the Yamaoka reference.

Independent claim 1 is directed to a method for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature utilizing an electronic control module, comprising the steps of: a) selecting a fuel type to be combusted; b) determining the latent heat of combustion of the selected fuel type; c) selecting a flow rate of the combustion fuel; d) determining the heat capacity of the catalyst to be heated in the catalytic reformer; e) determining a mass of the reformer to be heated; f) determining a

starting temperature of the catalytic reformer; g) utilizing a software construct to produce the fuel combustion time interval, wherein the construct utilizes the latent heat of combustion, the selected combustion fuel flow rate, the heat capacity of the catalyst, the mass to be heated, and the starting temperature; and h) pre-heating the hydrocarbon catalytic reformer using a combustor for the fuel combustion time interval so that the hydrocarbon catalytic reformer reaches the minimum reforming temperature.

In the Final Office Action, the Examiner stated that Appellants argued that "the Dalla Betta reference fails to teach the determination of a fuel combustion time interval." *Final Office Action*, pg. 2, ¶ 4. Appellants would like to point out that the argument with respect to claim 1 is more specific than the Examiner has indicated. In particular, Appellants submit that the combination of the Dalla reference and the Yamaoka reference do not teach or suggest a method for pre-heating a hydrocarbon catalytic reformer comprising the steps of: <u>f) determining a starting temperature of the catalytic reformer; and g) utilizing a software construct to produce the fuel combustion time interval based on, among other factors, the starting temperature of the catalytic reformer</u> as recited in claim 1.

The Examiner acknowledged that the Dalla reference does not explicitly disclose a method that results in the production of a fuel combustion time interval, but instead relies on an implicit teaching in the Dalla reference. *See Final Office Action*, pg. 2, ¶ 4. Therefore, the threshold for establishing a prima facie case of anticipation based on an inherency theory is the same as set forth above. The Examiner must provide some specific evidence or scientific

reasoning to establish the reasonableness of the Examiner's belief that the steps of: f) determining a starting temperature of the catalytic reformer; and g) utilizing a software construct to produce the fuel combustion time interval based on, among other factors, the starting temperature of the catalytic reformer are necessarily disclosed in the combination of the Dalla reference and the Yamaoka reference. *See Skinner*, 2 USPQ2d at 1789.

In the Final Office Action, the Examiner stated that the Dalla reference's "disclosure of calculating the length of time of fuel reforming in rich mode (paragraph [0101]) does not preclude the significance and ability of [the Dalla reference] to implicitly calculate combustion time." *Final Office Action*, pg. 2, ¶ 4. Whether or not Appellants agree with the Examiner's statement, the burden still falls on the Examiner to show how paragraph [0101] of the Dalla reference necessarily discloses that a starting temperature of the catalytic reformer is used to produce a fuel combustion time interval so that the reformer reaches a minimum reforming temperature. Appellants maintain that the fuel processing referred to in paragraph [0101] is not related to the length of time that the fuel is combusted to heat the reformer (i.e., fuel combustion time interval), but is instead related to the length of time the fuel processor (reformer) is operated in a "rich mode," which relates to a reforming mode. *See Specification*, pg. 1, lines 26-28 (stating that a reformer operates in a fuel rich condition and a combustor operates in a lean fuel to air ratio). In other words, paragraph [0101] does not provide any evidence to conclude that a starting temperature of the fuel processor (i.e., reformer) is taken into consideration when determining how long

to use a combustor to pre-heat the reformer to a minimum reforming temperature.

The Examiner relied on paragraph [0095] of the Dalla reference to show that the amount of fuel that is fed to the reformer is calculated by integrating with respect to time, and therefore calculating time when fuel rate is known would be a known calculation. *See Final Office Action*, pgs. 2-3, ¶ 3. While the above rationale addresses the calculation of time for feeding fuel to a reformer, it does not in any way address the calculation of a fuel combustion time interval during which a combustor operates to pre-heat the reformer to a minimum reforming temperature, as recited in claim 1. Further, the Examiner's rationale also does not address how the alleged time interval for feeding fuel to the reformer in paragraph [0095] relates to the starting temperature of the catalytic reformer. It appears that the Examiner is attempting to correlate an entirely different aspect of the operation of a reforming system compared to what is being set forth in claim 1. The cited portions of the Dalla reference relate to calculating the fuel flow to a reformer, while claim 1 relates to calculating a fuel combustion time interval for a combustor to pre-heat the reformer to a minimum operating temperature. The Examiner also cited paragraph [0093] to support the above position. Appellants submit that paragraph [0093] relates to a nitrogen oxides storage-reduction ("NSR") emission control system, and does not relate to the production of a fuel combustion time interval based on the starting temperature of a reformer. *See also Dalla*, Abstract; FIG. 1.

The Examiner also pointed out that the rejection of claim 1 is based on the combination of the Dalla reference and the Yamaoka reference, and not the Dalla reference taken alone. Appellants acknowledge the combination of references, and submit that the Yamaoka reference fails to teach or suggest the limitations that were lacking in the Dalla reference for at least the reasons set forth above with respect to claim 6.

For at least the foregoing reasons, Appellants submit that a prima facie case of obviousness has not been established and request that the rejection of claim 1 be reversed. As claims 2-5 depend from claim 1, these claims are not taught or suggested by the combination of the Dalla and Yamaoka references for at least the same reasons that were set forth with respect to claim 1.

Since claims 10-19 also include limitations that are similar to those that were argued above with respect to claim 1, Appellants submit that claims 10-19 are not taught or suggested by the combination of the Dalla and Yamaoka references for at least the same reasons that were set forth with respect to claim 1. It is requested that the rejection of claims 10-19 be reversed.

Issue 3 – Whether claim 8 is unpatentable under 35 U.S.C. § 103(a) based on the Yamaoka reference in view of the Dalla reference.

Claim 8 depends from claim 6 and states that the software construct is an algorithm having the linear form y = mx + b, wherein y is the minimum reforming temperature, b is the starting temperature, m is an integral of a product of the latent heat of combustion of the fuel times the selected flow rate of the fuel,

divided by a product of the mass of the reformer to be heated times the heat capacity of the mass, and x is the fuel combustion time interval.

Since claim 8 depends from claim 6, Appellants submit that the Yamaoka reference fails to teach or suggest all of the limitations included therein for at least the same reasons that were set forth above with respect to claim 6. In particular, the Yamaoka reference does not teach or suggest a catalytic hydrocarbon reformer including an electronic control module that is programmed with a software construct for determining <u>a fuel combustion time interval for pre-heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature</u>. The Dalla reference also fails to teach or suggest the above limitation that was lacking in the Yamaoka reference. It is therefore requested that the rejection of claim 8 be reversed.

Issue 4 – Whether claim 9 is unpatentable under 35 U.S.C. § 103(a) based on the Yamaoka reference in view of the Grieve reference.

Claim 9 depends from claim 6 and states that the fuel cell assembly includes a solid oxide fuel cell.

Since claim 9 depends from claim 6, Appellants submit that the Yamaoka reference fails to teach or suggest all of the limitations included therein for at least the same reasons that were set forth above with respect to claim 6. In particular, the Yamaoka reference does not teach or suggest a catalytic hydrocarbon reformer including an electronic control module that is programmed with a software construct for determining <u>a fuel combustion time interval for pre-</u>

heating the hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature. The Grieve reference also fails to teach or suggest the above limitation that was lacking in the Yamaoka reference. It is therefore requested that the rejection of claim 9 be reversed.

Conclusion

For the foregoing reasons, Appellants submit that the references of record fail to teach or suggest every limitation disclosed in claims 1-19, and request that the rejections of these claims be reversed.

Respectfully submitted,

Dated: 7/23/2008

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VIII. CLAIMS APPENDIX

The text of the claims involved in the appeal reads as follows:

1. A method for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature utilizing an electronic control module, comprising the steps of:

a) selecting a fuel type to be combusted;

b) determining the latent heat of combustion of said selected fuel type;

c) selecting a flow rate of said combustion fuel;

d) determining the heat capacity of the catalyst to be heated in said catalytic reformer;

e) determining a mass of said reformer to be heated;

f) determining a starting temperature of said catalytic reformer;

g) utilizing a software construct to produce said fuel combustion time interval, wherein said construct utilizes said latent heat of combustion, said selected combustion fuel flow rate, said heat capacity of said catalyst, said mass to be heated, and said starting temperature; and

h) pre-heating said hydrocarbon catalytic reformer using a combustor for said fuel combustion time interval so that said hydrocarbon catalytic reformer reaches said minimum reforming temperature.

2. A method in accordance with Claim 1 wherein said software construct includes an algorithm, software code modules, or interface specifications.

3. A method in accordance with Claim 1 wherein said software construct is an algorithm having the linear form y = mx + b.

4. A method in accordance with Claim 3 wherein

y is said minimum reforming temperature;

b is said starting temperature;

m is an integral of a product of said latent heat of combustion times said selected flow rate of said combustion fuel, divided by a product of said mass to be heated times the heat capacity of said mass; and

x is said fuel combustion time interval.

5. A method in accordance with Claim 1 wherein said minimum reforming temperature is about 500°C.

6. A catalytic hydrocarbon reformer for making reformate, comprising:

an electronic control module for controlling the flow of hydrocarbon fuel and air into said reformer,

wherein said electronic control module is programmed with a software construct for determining a fuel combustion time interval for pre-heating said hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature.

7. A catalytic hydrocarbon reformer in accordance with Claim 6 wherein said software construct includes an algorithm, software code modules, or interface specifications.

8. A catalytic hydrocarbon reformer in accordance with Claim 6 wherein said software construct is an algorithm having the linear form $y = mx + b$, and wherein

y is said minimum reforming temperature;

b is said starting temperature;

m is an integral of a product of the latent heat of combustion of said fuel times the selected flow rate of said fuel, divided by a product of the mass of said reformer to be heated times the heat capacity of said mass; and

x is said fuel combustion time interval.

9. A catalytic hydrocarbon reformer in accordance with Claim 6 wherein said fuel cell assembly includes a solid oxide fuel cell.

10. A computing system having a processor, a memory and an operating environment operable to execute a method for determining a fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature, the method comprising:

a) selecting a fuel type to be combusted;

b) determining the latent heat of combustion of said selected fuel type;

c) selecting a flow rate of said combustion fuel;

d) determining the heat capacity of the catalyst to be heated in said catalytic reformer;

e) determining a mass of said reformer to be heated;

f) determining a starting temperature of said catalytic reformer; and

g) utilizing a software construct to produce said fuel combustion time interval, wherein said construct utilizes said latent heat of combustion, said selected combustion fuel flow rate, said heat capacity of said catalyst, said mass to be heated, and said starting temperature.

11. A computing system in accordance with Claim 10 wherein said software construct includes an algorithm, software code modules or interface specifications.

12. A computing system in accordance with Claim 10 wherein said software construct is an algorithm having the linear form y = mx + b.

13. A computing system in accordance with Claim 12 wherein

y is said minimum reforming temperature;

b is said starting temperature;

m is an integral of a product of said latent heat of combustion times said selected flow rate of said combustion fuel, divided by a product of said mass to be heated times the heat capacity of said mass; and

x is said fuel combustion time interval.

14. A computing system in accordance with Claim 10 wherein said minimum reforming temperature is about 500°C.

15. A computer readable medium having computer executable instructions of a wired media type for performing a method for determining a fuel combustion time interval for pre-heating a hydrocarbon catalytic reformer from a starting temperature to a minimum reforming temperature, comprising the steps of:

a) selecting a fuel type to be combusted;

b) determining the latent heat of combustion of said selected fuel type;

c) selecting a flow rate of said combustion fuel;

d) determining the heat capacity of the catalyst to be heated in said catalytic reformer;

e) determining a mass of said reformer to be heated;

f) determining a starting temperature of said catalytic reformer; and

g) utilizing a software construct to produce said fuel combustion time interval, wherein said construct utilizes said latent heat of combustion, said selected combustion fuel flow rate, said heat capacity of said catalyst, said mass to be heated, and said starting temperature.

16. A computer readable medium in accordance with Claim 15 wherein said software construct includes an algorithm, software code modules or interface specifications.

17. A computer readable medium in accordance with Claim 15 wherein said software construct is an algorithm of the linear form y = mx + b.

18. A computer readable medium in accordance with Claim 17 wherein

y is said minimum reforming temperature;

b is said starting temperature;

m is an integral of the product of said latent heat of combustion times said selected flow rate of said combustion fuel, divided by a product of said mass to be heated times the heat capacity of said mass; and

x is said fuel combustion time interval.

19. A computer readable medium in accordance with Claim 15 wherein said minimum reforming temperature is about 500°C.

IX. EVIDENCE APPENDIX

There has been no additional evidence submitted, entered by the Examiner, or relied upon by the Appellants in the present appeal.

X. RELATED PROCEEDINGS APPENDIX

There have been no proceedings or decisions rendered by a court or the Board that relate to the present patent application.